

Start-ups may get funding
help from Congress

PAGE 55

Far East is best bet for
connector makers

PAGE 79

New tools for taming the
computer network

PAGE 71

A CAHNERS PUBLICATION

Electronic Business[®]

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES WORLDWIDE

NOVEMBER 4, 1991

INTERNATIONAL REPORT

- ▶ Where's the recession headed next? **PAGE 23**
- ▶ Why cost of capital still hurts the U.S. **PAGE 40**
- ▶ Which company topped our international list **PAGE 50**



Electronic Business

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES—WORLDWIDE

VOLUME 17, NUMBER 21

NOVEMBER 4, 1991



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The 1990-91 recession seems to be bouncing all over the globe. Everyone will be left a little bruised and battered before it's finished. Our predictions:

- Uninspired recovery for the U.S.
- Japan next in line for the recession
- Western Europe stuck in a slump
- Pacific Rim: bright spot for electronics

Cover illustration by Meryl Sklut

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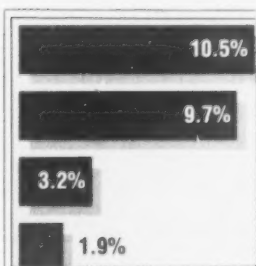
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79 Time's running out for U.S. connector makers

Lousy demand and a crowded marketplace have made price lists "good only for drawing pictures on," grumbles one vendor. For globally positioned companies and niche suppliers, the biggest growth opportunities lie in Japan and the Pacific Rim

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INSIDE BUSINESS

Memorial tribute to Cahners chairman Ronald Segel

THIS SPACE is usually reserved for previewing the important articles you'll find inside ELECTRONIC BUSINESS, but I would like instead to take you inside Cahners Publishing Co. for a moment to share with you our sad loss at the recent death of Ronald Segel, chairman and chief executive of Cahners Publishing and deputy chief executive of the parent company, Reed International plc. Ron died on August 30, at the age of 56, after a year's bout with cancer.

When Ron joined Cahners in 1971 as vice president of finance, we were a trade magazine company with annual revenue of \$50 million. Today, after 20 years in which he rose to become president and chief operating officer and ultimately chairman, Cahners is the core of a \$1.3 billion communications company.

Cahners Magazine Co., with 84 publications, is now the leading business-to-business publisher in the United States and a growing force in consumer publishing. Our sister

exhibit company has become the world's leading organizer of trade shows and exhibitions.

That is a performance in which any business leader could take justifiable pride. Ron Segel's fingerprints can be found on every element on it. His vision and rare judgment will ensure that we continue to grow as a company by enhancing our value to our readers and advertisers.

Ron was a native Bostonian who was a proud graduate of Harvard and Harvard Business School. He was a quiet and private man who spoke most eloquently through his vision for Cahners, his integrity, and his dedication to our people and to those—like you—we serve.

We at Cahners will miss him, and we will honor his memory by our commitment to a climate of excellence in publishing, the founding goal of Norman Cahners that was cherished and nurtured by Ron Segel for 20 years.

—John Russell, editor

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VBPA ABP

STANDARDS

What future is in the PC cards?

BETTER KNOWN for endlessly haggling over standards, computer vendors have endorsed a single PC card interface specification that experts say will change the look, weight, and power requirements of portable PCs.

In addition to spelling "opportunity" for PC manufacturers, the

cards and their applications will require new kinds of components, interconnection, and packaging technology from their suppliers. Devices that use PC cards could amount to some 22 million units by 1995.

By late September, more than 150 electronics industry vendors jumped on the PC Memory Cards International Association

(PCMCIA) bandwagon, endorsing form factor, input/output, execution software, and power specs. To what extent they'll design to that spec is yet unclear.

The new cards can contain specialized microcontrollers, coprocessors, DRAM memory or cache memory, disk-drive-like flash EPROM storage, modems, faxes, LAN adapters, and combinations of the above.

Standards-backers now include Hewlett-Packard, IBM, Intel, Zenith Data Systems, Poqet Computer, and even Polaroid, which is considering the card as a sort of reusable "film" for digital cameras. That's a pretty impressive bunch so far.

The size of a thick credit card, PC cards are lightweight, durable, and power-efficient, and they are interchangeable with other PC-

MCIA socket-equipped PCs. Because of their size and versatility, PC cards will catalyze hardware downsizing, says Randy Battat, VP for portable computing at Apple.

Sun Disk, for one, packs eight partitionable flash EPROM chips into a single card to achieve 10 Mbytes of capacity. The product is virtually indestructible compared with a disk drive. SunDisk's proprietary EPROMs have 512-byte erasable partitions, as do magnetic disk drives. Intel's comparable Flashcard requires erasure of an entire chip except for one portion designated as a "boot block" for non-rewriteable code.

Intel, however, currently is the only company offering a modem-in-a-card, a 2400-baud, 2.5-inch form factor device that supports the Hayes AT command set and just about any PC communications software. Companies such as 3Com are expected to produce LAN adapter cards for portable PCs. So-called "smart cards" and microprocessor-embedded cards for printers, faxes, and scanning equipment are also expected.

The cards will be pricey, at least until volumes reach millions of units. Storage cards, for example, are expensive—about \$75 per Mbyte is SunDisk's initial volume price point, compared with about \$4 per Mbyte for disk drives. Vendors expect card prices to drop below \$50 per Mbyte next year and continue down each year as production volumes jump.

—By David Webb in San Jose

Memory cards mean growth for OEMs

Forecast for devices that will use memory cards*
(Worldwide shipments, millions of units)

	DEATH.	TEMPERANCE.	STRENGTH.
			
	Pessimistic	Likely	Optimistic
1993	2.6	12.5	19
1995	3.9	17.6	22

*Varying models based on the rate of penetration of high-functional vs. low functional PC cards

Worldwide PC card* shipments

(millions of units)

	DEATH.	STRENGTH.
		
	Pessimistic	Optimistic
1993	52	87
1995	105	268

*Includes LAN adapters, memory cards, disk-drive emulation cards, modems, and faxes

Source: SRI International

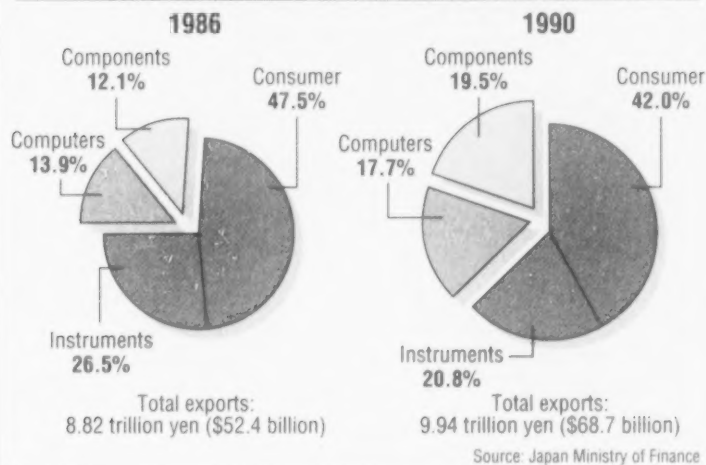
OPERATING SYSTEMS

Sun's Solar(is) flare stirs up the PC market cauldron

SUN MICROSYSTEMS' shrink-wrapped Unix strategy may not be a direct response to the Advanced Computing Environment (ACE) initiative, but it definitely turns up the heat on the consortium to get ACE-based products out the door. Sun's Solaris 2.0 is a System V.4-compliant version of the original Sun Unix operating system and is designed to

TRADE

Japan's exports shift to computers and components



Japan exported \$68.7 billion worth of electronics products last year. The trend since 1986 shows computers and components accounting for a greater and greater share of Japan's exports. In fact, despite declining prices, Japan's exports of computers grew 13.6% (valued in yen) last year. Consumer electronics grew only 10.2%, instruments rose 7.7%, and components exports fell 0.8% as memory device prices tumbled. Consumer electronics is not expected to fuel Japan's export growth in the future; computers are clearly expected to pick up the slack.

—Elizabeth B. Baatz

ered "ACE-only." So far, Mips Computer, The Santa Cruz Operation, and other ACE supporters haven't disclosed intentions to license GL.

—By David Webb in San Jose

INTERNATIONAL

Managed network venture finally unites telecom giants

POTENTIAL PROFITS from managed networks—a \$2.8 billion global market—have the world's telecom companies trying to convince large users to outsource management of their voice, data, and image-network services.

Even the promise of that market's

15% annual growth wasn't enough to unite a would-be consortium of telecom giants. Nippon Telegraph and Telephone and Deutsche Bundespost Telekom failed to join British Telecommunications at the launch of a new managed-network company. Instead, Telekom, France Telecom, and MCI Communications began separate talks on an alternate outsourcing consortia.

It's still unclear how successful the new arrangement will be. Originally, the three were to provide multinational users customized, high-speed, non-switched services. Instead, BT alone launched Atlanta-based Syncordia, which offers those same users network management services, customized billing, and multi-lingual customer service.

It won't be easy. "Outsourcing as a concept in telecom is still at a relatively early stage," says Laurence Heyworth, an analyst with Robert Fleming Securities Ltd. in London. That explains one thing: Syncordia had no customers at the time of its September launch. Amadeus, the airline reservations system, chose Syncordia to manage its trans-Atlantic service one week later. BT's Tymnet sales force will peddle Syncordia's services in the U.S.

—Barbara N. Berkman in London

STRATEGIES

IBM readies to sell OS/2 2.0 to other vendors

IBM's SEEMINGLY endless and some say fruitless battle to make OS/2 an industry standard is taking a new twist. Big Blue may start licensing OS/2 to rival PC vendors in a last-ditch effort to stem the rise of Microsoft's Windows 3.0.

IBM will begin shipping OS/2 Release 2.0 before the end of this year. Observers speculate that IBM, fearful that Microsoft may not aggressively market OS/2 2.0, will go one step further and license the PC operating system to competitors.

Such a move indicates "a profound attitude change at IBM—a recognition that cooperation with competitors can further a strategic objective," UBS Securities Inc. analyst Marc Schulman says in a report.

IBM and Microsoft, once united in their support of OS/2, have been moving apart in recent years with Microsoft increasingly emphasizing its successful Windows 3.0 system software. Although it's Microsoft's responsibility to license OS/2 2.0 to other vendors, IBM is worried that Microsoft may try to "sabotage" OS/2 by not actively marketing it, Schulman says. In order for OS/2 to succeed as an industry standard, other PC vendors must adopt it.

IBM is reportedly ready to step in and begin licensing OS/2 2.0 to other vendors within 45 to 60 days if it

BUSINESS TRENDS

believes Microsoft is stalling. Schulman says IBM has already held discussions with other PC makers, including arch rival Compaq Computer.

—By Rick Whiting

DATA COMMUNICATIONS

Will Synernetics/3Com deal ripple the LAN hub market?

A TECHNOLOGY and development agreement between Synernetics and 3Com attempts to make a big splash in the business of intelligent networking hubs. Nevertheless, it's not expected to significantly challenge established vendors such as SynOptics and Cabletron.

Intelligent hubs have become a popular solution for achieving computer networking, racking up 1990 U.S. sales of \$381 million, says Dataquest. A single hub typically supports several types of LANs and allows stations on attached networks to communicate with one another.

The five-year contract could bring start-up Synernetics up to \$18 million in revenue and may help 3Com jump-start its hub operation. 3Com customers also can gain assurance that 3Com is laying the foundation for future development on their cur-

rent generation of technology.

Synernetics introduced its LANplex 5000 intelligent hub in the fall of 1990. 3Com lagged in the development of its own hub and has been sourcing hubs from market-leader SynOptics. Now, for its next-generation product, 3Com will go with Synernetics.

3Com initially will resell the LANplex 5000 hub but has the right to manufacture its own hubs based on the architecture in the future. 3Com will also buy several Synernetics modules for the hubs, including an FDDI concentrator and a high-performance Ethernet module.

—By Dwight Davis in Seattle

SOFTWARE

Software pirates' booty costs industry big bucks

THE NEXT TIME YOU download that new software program for a co-worker consider this: In the eyes of the software industry, that's piracy, and you may be taking a bigger chance than you realize.

The software industry is getting more aggressive in prosecuting pirates because it's losing big bucks in potential revenue—an estimated \$2.2 billion in the United States alone, according to a study by the Software Publishers Association (SPA).

Executive director Ken Wasch admits the SPA's bark has been worse than its bite, but its aggression is now fueled by added resources, by a piracy hotline, and by educating the user base. The last two work hand-in-hand: More than 95% of reported piracies come from employees blowing the whistle on their own companies. "It's a messy business," Wasch concedes. "We're filing suits at a rate of two per week." The SPA expects to file 100 suits on behalf of the industry in 1991—twice the number filed in either '89 or '90.

The recovered money from the suits goes into the SPA copyright protection fund. The group is also backing a proposal in the Senate that could give electronics software the

same kind of protection granted to audio-visual software, making it a felony to copy and distribute it.

The SPA hotline is (800) 388-7478.

—By Barbara Jorgensen

MULTIPROCESSING SYSTEMS

Super servers attack enterprise-wide networking

SUN MICROSYSTEMS and Control Data this fall introduced multiprocessing systems aimed at capturing more of the high-performance network server market. In addition to opening a new market for box makers such as Sun, these systems offer Sparc and Mips chip makers the opportunity to sell not just one, but perhaps four or more chips into a single box.

Systems such as Sun's and CDC's target applications traditionally handled by superminis or mainframes. Such servers handle a large number of users and even other servers as well as complex data bases and applications.

The Sun servers are powered by multichip processor modules from Cypress. Cypress also adds value in the design of the modules, which reduces the OEM's design effort.

Sun unveiled the SparcServer 600MP Series with modular dual-processor designs that allow the Cypress modules to be easily replaced with new ones containing Sun's Viking processor produced by Texas Instruments.

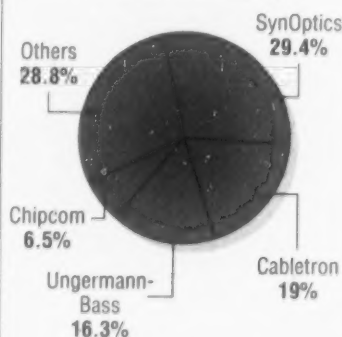
The CDC servers, with processors based on Mips' RISC architecture, are referred to as "Infoservers." Customers are looking to the new CDC 4680 systems to offer an upgrade path as processing needs increase.

Multichip processor modules are difficult to design because of timing problems between the different processors. Designing the cache controller and processor interface into an easily plugged-in module allows OEMs to get their systems and future upgrades to market faster, without the engineering expensive of designing their own processor interface.

—By Hugh G. Willett in San Jose

Intelligent hub market leaders

(% share, U.S. market)

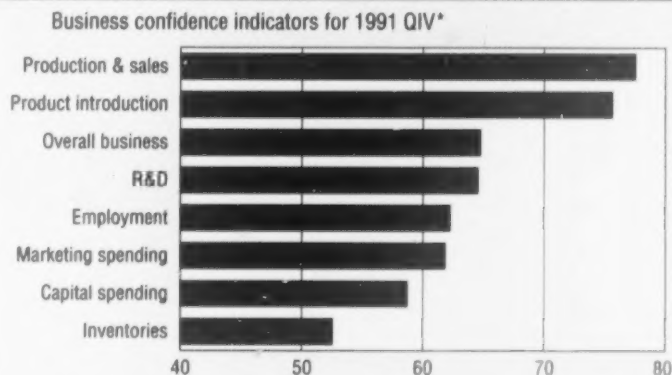


1990 U.S. market = \$381 million

Source: Dataquest Inc.

BUSINESS BAROMETER

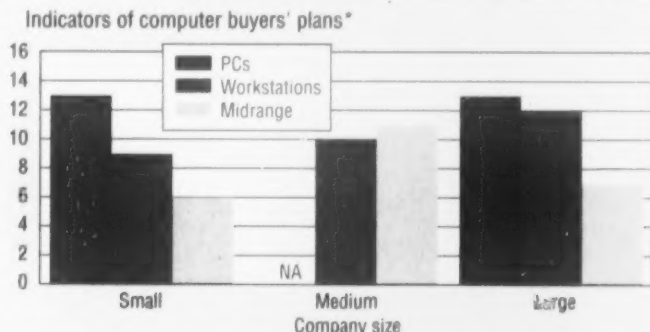
Capital spending expectations hang low...



* Indicators are percentage of respondents who expect increases plus half of respondents who expect no change

Source: Cahners Economics survey, Sept. 1991

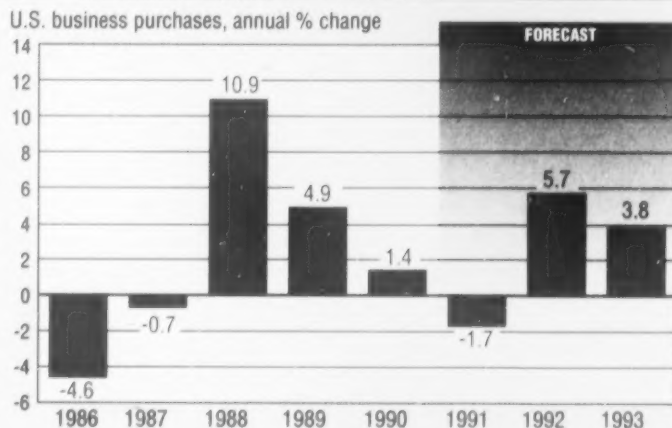
...but anticipated computer buys for '92 look better..



* Indicators are percentage of sites that expect to spend more minus sites that expect to spend less over the next 12 months
NA = not available

Source: Datamation/Cowen & Company survey, Sept. 1991

...which will help boost spending on computers



Source: Commerce Dept.; forecast: Cahners Economics

How investment drives computers

WHILE BUSINESS confidence slowly rekindles the economy, expectations for any immediate buying binge remain lukewarm, but spending will heat up once more in 1992 and 1993.

U.S. businesses purchased \$40.7 billion worth of computers and office equipment last year, only a 1.4% increase. As the economy slid further into recession through the first half of this year, business spending for such equipment dropped 4.7% from fourth quarter 1990 to first quarter 1991 and dipped another tenth of a percent from the first quarter to the second. Cahners Economics predicts investment will be down 1.7% this year, the worst since a 4.6% loss in 1986. Cahners's new business confidence indexes confirms the forecast. Of all the barometers of business activity surveyed by Cahners, managers are most pessimistic about capital spending and inventory plans.

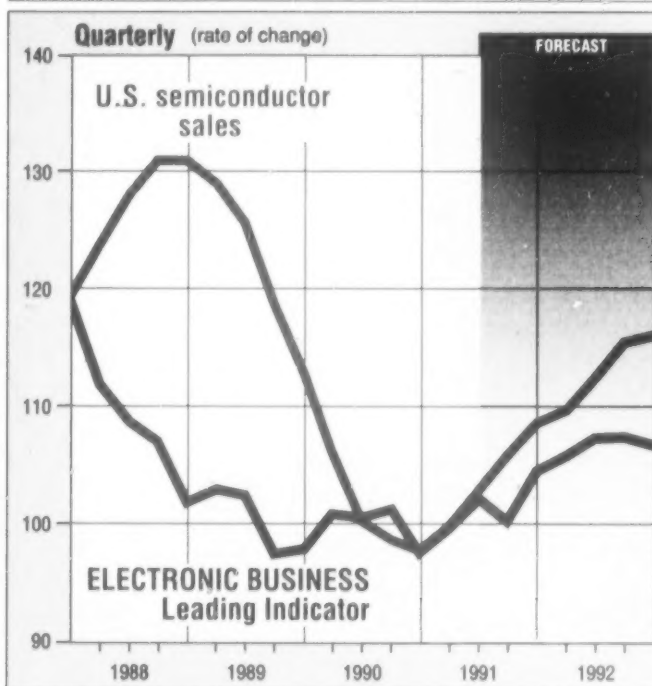
As usual, business managers want to see sustained growth in production and sales for several months before committing to new capital equipment purchases. Once companies overcome their spending shyness, computer and office equipment makers should benefit. A recent *Datamation/Cowen & Company* study on computer buying patterns revealed companies that anticipate increasing spending in the next 12 months for PCs, workstations, and midrange systems outnumber those that expect to cut spending.

With the economy recovering and businesses, in general, spending about 11% of their total equipment budget just on computers and office equipment alone, Cahners Economics maintains a bullish outlook for capital spending. The forecast calls for a 6% rise in U.S. business purchases of computers and office equipment in 1992 and a 4% gain in 1993.

—Madeline Franchi

BUSINESS BAROMETER

ELECTRONIC BUSINESS Leading Indicator

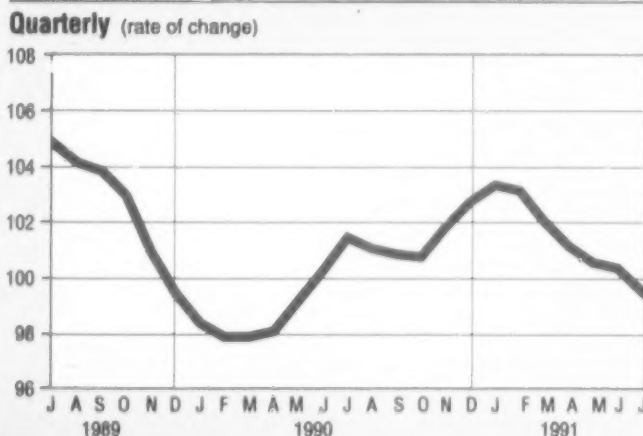


Summertime blues hit Leading Indicator

THE ELECTRONIC BUSINESS Leading Indicator (EBLI) fell again in August to 99.1, the second month below the break-even 100 mark. It is unclear if that is warning of a double-dip recession, but expect a period of anemic growth in the near-term before healthier gains in 1992. Inventory growth usually picks up before a recovery but has fallen for the past six months.

EBLI is a weighted composite of six statistics which lead activity in the electronics industry. To obtain a complimentary background paper, contact Cahners Economics, 275 Washington St., Newton, MA 02158-1630, USA; telephone (617) 630-2119; or fax (617) 630-2100.

Cautious managers keep inventory lean



Source: Commerce Dept.

	Latest month	Previous month	Year ago	1990 average
ELECTRONIC BUSINESS Leading Indicator (rate of change, August)	99.1	99.4	100.8	99.9
U.S. semiconductor bookings (\$ millions, 3-month average, August)	\$1,206	\$1,237	\$1,220	\$1,254
Weekly hours of semiconductor production workers (monthly average, July)	40.7	40.8	39.4	40.4
Electronic components lead time index (1977 = 100, September)	81.4	75.3	80.6	80.7
S&P's semiconductor stock price index (1970 = 10, monthly average, August)	72.3	68.3	64.1	64.6
Change in electronic components inventories (\$ millions, SA, July)	\$60	-\$30	\$208	\$33
Contracts and orders for plant and equipment (\$ billions, SA, July)	\$39.1	\$32.0	\$39.9	\$38.3

SA = seasonally adjusted; all other data are not seasonally adjusted

Sources: Semiconductor Industry Association, Bureau of Labor Statistics, Electronics Purchasing, Standard & Poor's, Commerce Dept., Bureau of Economic Analysis



Where's the **RECESSION** heading next?

As downturns go, this one has been the most confusing in memory. The recession seems to have taken on a life of its own as it hopscotches the globe and raises general mayhem before moving on.

In the following pages, we assess the damage wreaked by the economy during the past year and predict the fallout. Some highlights:

- The U.S. may be out of the woods, but keep the champagne on ice for a while. The expected improvement in gross national product during the second half of the year is unlikely to compensate for limping production rates and tight credit policies attributable to the S&L scandal;
- Officially, Western Europe is out of the recession. Unofficially, most of its economies are in

limbo because of the collapse of the former Soviet bloc and a slowdown by the German juggernaut as it integrates its eastern regions. Don't expect much real growth before 1993;

- Even Japan is looking a bit wan. Growth, both this year and next, is pegged at 3.5%, compared with last year's 5.6%. Also, look for a rising yen to put a crimp in Japanese exports and a possible domestic labor shortage that will drive up production costs;

- If you're looking for solid growth prospects, try the Pacific Rim nations. Sources predict major high-tech expansion in the area, particularly in Taiwan. Projected growth rates for next year range as high as

8% for South Korea, and 7.5% for Singapore. □





UNITED STATES

The recession is over. Now for the doldrums



Although the GNP fell 0.5% in the second quarter, the recession is probably already over. Economists point to increased industrial production for the five consecutive months begin-

ning in March. However, the electronics industry should expect little in the way of a post-recession boom.

"Despite signs of improvement, the numbers aren't anything to get excited about," says Richard O'Brien, chief economist of Hewlett-Packard Co. in Palo Alto, Calif.

This uninspiring recovery has been with us since the beginning of the year. The ELECTRONIC BUSINESS Leading Indicator turned the corner in January, but Cahners economist Madeline Franchi expects the index to rise only 14 points between January and June of 1992—a far cry from the 30-point increase in the 10 months following the 1985 recession.

Chip markets should show the most growth. The Semiconductor Industries Association says North American chip sales will rise 8.5% this year and 16% in 1992. Sales of capital equipment, computers, and telecommunications will remain sluggish—well under 10%.

A host of factors dampen the U.S. recovery. Defense cutbacks hurt OEM sales. The rise of the U.S. dollar overseas in response to political turmoil and weak economies abroad shackles exports. Improved inventory control by U.S. companies will temper the recovery as it tempered the recession. Fiscal conservation by the Federal Reserve Bank, along with the savings and loan crisis and the shaken confidence of the nation's banks, should keep credit tight.

—By Peter Burrows

North America at a glance in 1990

Population = 276.2 million

Size of economy = \$5.4 trillion (U.S. \$)

Size of electronics market = \$232 billion (U.S. \$)

Gross domestic product per capita = \$19,551 (U.S. \$)

Education indicator* = 60% to 62%

North America includes United States and Canada

* Percentage of 20- to 24-year-olds getting a post-secondary education in 1988

The outlook

(annual % change**)

	1990	1991	1992
GNP	0.9%	-0.3%	3.1%
Electronics market	0.7	-0.1	2.9

Best growth prospects:

Automotive electronics	-1.7	0.6	24.2
Semiconductors	-2.6	8.5	16.0

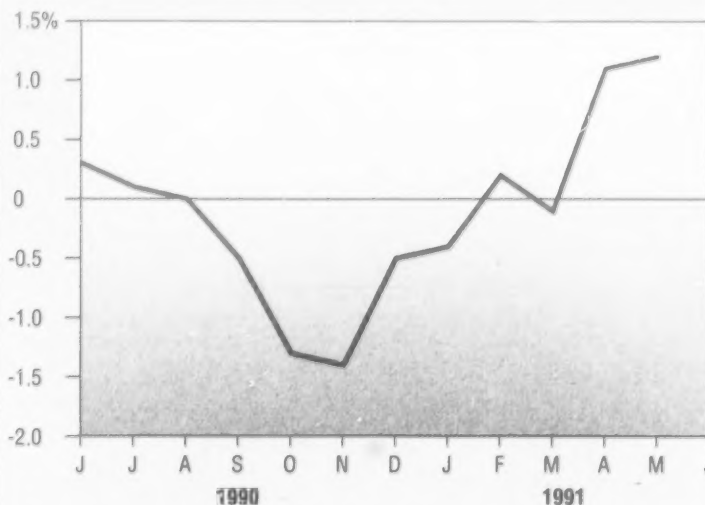
Worst growth prospects:

Government and military	0.41	-0.2	-2.9
Consumer electronics	-0.3	-2.0	7.4

**GNP adjusted for inflation; all data assumes constant exchange rates

North America's economic leading indicator

(monthly % change)



Source: Cahners Economics, Columbia University's Center for International Business Cycle Research, Elsevier Advanced Technology, The World Bank, Organization for Economic Cooperation and Development, International Monetary Fund, Electronic Outlook Corp.



WESTERN EUROPE

Western Europe limps along



Buffeted by a global recession, the opening of the Eastern bloc, and various country-specific problems, Western Europe will escape 1991 with a collective GNP growth of just over 2%. While

the region is no longer in recession, whatever it is in isn't much better.

The region's growth should improve slightly to 2.4% in 1992, according to Elsevier Advanced Technologies in London, but don't expect any hot spots to emerge. Germany, the locomotive of the European economy, will grow only 2% as it struggles to integrate the economy of the former East Germany. German trading partners such as Austria, Denmark, and the Netherlands will fare just a few tenths of a percentage point better. Scandinavia will suffer from a dearth of activity with a tumultuous U.S.S.R. and an impoverished former Eastern bloc. France grapples with losses at state-supported companies, and Spain and Italy struggle with labor shortages and inflation set off by manufacturing investments in the 1980s. The U.K., meanwhile, wonders why it is still in the throes of the recession.

Simply stated, the political turmoil in Europe and the Middle East will prevent a meaningful economic upturn. Western European companies anticipate the integration of the European Community and the creation of an economic infrastructure for Eastern Europe. Even erstwhile trading partners in the Middle East are uncertain, as Iraq remains in economic quarantine and Saudi Arabia and Kuwait favor U.S. companies in return for America's leadership role in the Gulf war.

—By Peter Burrows

Western Europe at a glance in 1990

Population = 233.4 million

Size of economy = \$4.2 trillion (U.S. \$)

Size of electronics market = \$131 billion (U.S. \$)

Gross domestic product per capita = \$17,995 (U.S. \$)

Education indicator* = 23% to 32%

Western Europe includes Germany, United Kingdom, Italy, and France

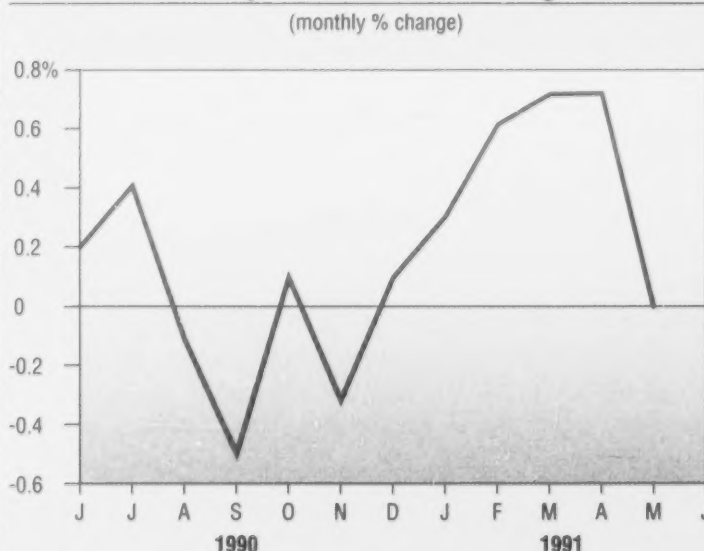
*Percentage of 20- to 24-year-olds getting a post-secondary education in 1988

The outlook

	(annual % change**)		
	1990	1991	1992
GDP	2.9%	1.2%	2.2%
Electronics market	2.5	2.6	3.0
Best growth prospects:			
Automotive electronics	11.1	15.9	13.2
Communications	7.2	5.0	8.5
Worst growth prospects:			
Government and military	5.1	5.4	5.3
Instruments	7.0	1.2	5.4

**GDP adjusted for inflation; all data assumes constant exchange rates

Western Europe's economic leading indicator



Source: Columbia University's Center for International Business Cycle Research, Elsevier Advanced Technology, The World Bank, Organization for Economic Cooperation and Development, International Monetary Fund, Electronic Outlook Corp.



JAPAN

Is Japan next in line for the recession?

The Japanese juggernaut may be running out of steam.

Not that Japan's economy is on the verge of a major contraction or that its influence in world electronics markets is on the

wane. Japan "is certainly up there at the top of the list of countries in good economic health," says Paul Nesdore, manager of international planning services at IDC.

Observers, however, are sounding warning bells about Japan's economy, the world's second-largest. Citing a sharp decrease in its leading index for the last year, The Conference Board Inc., a New York-based economic research firm, concludes that the Japanese economy is "headed for a slowdown or recession."

The U.S. Department of Commerce predicts that Japan's GNP will grow by around 3.5% both this year and in 1992, down from last year's 5.6%. The Singapore-based Pacific Economic Cooperation Conference expects GNP to reach only 3% this year and 4.3% in 1992. The Conference Board also expects the Japanese yen to strengthen over the next few years, making Japanese goods more expensive in foreign markets.

Nesdore says there are opportunities for U.S. companies in Japan "if you're in the right sector and if you know what you're doing." Demand for computer software and services in Japan is expected to grow 17% a year through 1995, for example. The IDC analyst speculates that a projected labor shortage could force Japan to import more electronics products such as components rather than manufacture everything itself.

—By Rick Whiting

Japan at a glance in 1990

Population = 123.5 million

Size of economy = \$2.8 trillion (U.S. \$)

Size of electronics market = \$131 billion (U.S. \$)

Gross domestic product per capita = \$22,672 (U.S. \$)

Education indicator* = 30%

*Percentage of 20- to 24-year-olds getting a post-secondary education in 1988

The outlook

(annual % change**)

	1990	1991	1992
GDP	5.6%	3.5%	3.5%
Electronics market	4.5	3.6	5.0

Best growth prospects:

Automotive electronics	6.4	7.0	14.9
Computers	4.2	6.0	13.1

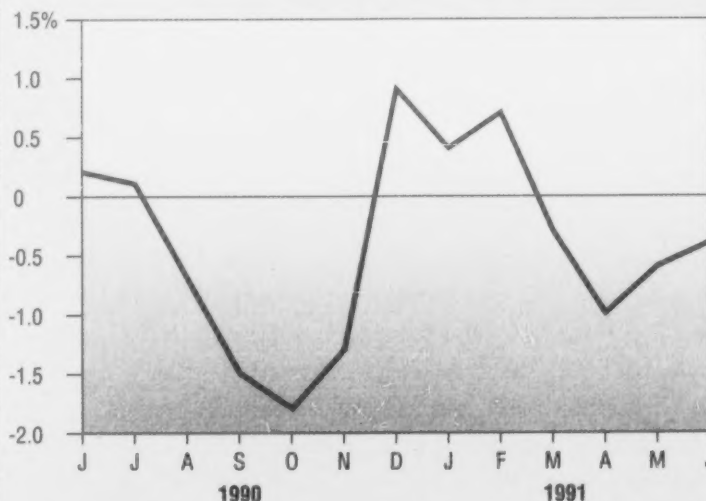
Worst growth prospects:

Consumer electronics	3.8	3.1	7.2
Government and military	5.0	4.6	6.2

**GDP adjusted for inflation; all data assumes constant exchange rates

Japan's economic leading indicator

(monthly % change)

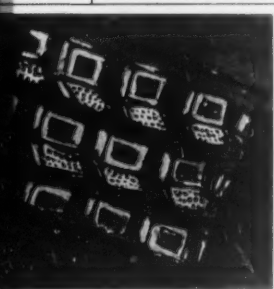


Source: Columbia University's Center for International Business Cycle Research, Elsevier Advanced Technology, The World Bank, Organization for Economic Cooperation and Development, International Monetary Fund, Electronic Outlook Corp.



PACIFIC RIM

Pacific Rim beckons U.S. companies on the move



The Asia/Pacific Rim area presents a paradox for growth-minded U.S. electronics companies. On one hand, Taiwan and Korea face rising labor costs, Thailand often appears

politically unsettled, and Hong Kong is beset by uncertainty about China's scheduled 1997 takeover. On the other hand, the region is a hotbed of growth and opportunity.

"The economies of the Asia/Pacific countries are stronger than those of the United States and Europe," says Thomas Hillman, managing director of international operations for Star Technologies Inc., a Sterling, Va., vendor of network computer servers.

Taiwan is rebounding from a mild recession, and South Korea's economy is expanding at a steady clip. A report from the Pacific Economic Cooperation Conference (PECC) predicts that South Korea's gross domestic product (GDP) will increase by 8.5% this year and 8% in 1992. The U.S. Department of Commerce estimates that Taiwan's economy will expand 8% this year and 5% in 1992. International Data Corp. (IDC) predicts economic growth of about 7% this year in Singapore and 3% in Hong Kong.

Other fundamental changes are underway in the Pacific Rim. Increasing labor costs are pushing volume manufacturing operations from Taiwan and Korea to Thailand, Malaysia, and the Philippines. The PECC report forecasts that Thailand's GDP will grow 9% this year and 6.8% in 1992. Malaysia's GDP growth will be 8.3% in 1991 and 8% in 1992, while Singapore will see 7.5% growth next year.

—By Rick Whiting

Pacific Rim at a glance in 1990

Population = 71.4 million

Size of economy = \$435 billion (U.S. \$)

Size of electronics market = \$35 billion (U.S. \$)

Gross domestic product per capita = \$6,092 (U.S. \$)

Education indicator* = 37% to 44%

Pacific Rim includes Singapore, South Korea, Hong Kong, and Taiwan

*Percentage of 20- to 24-year-olds getting a post-secondary education in 1988

The outlook

(annual % change**)

	1990	1991	1992
GDP	5.9%	5.6%	6.5%
Electronics market	5.2	5.0	6.0

Best growth prospects:

Semiconductors	18.2	19.7	19.7
Computers	8.0	10.7	18.7

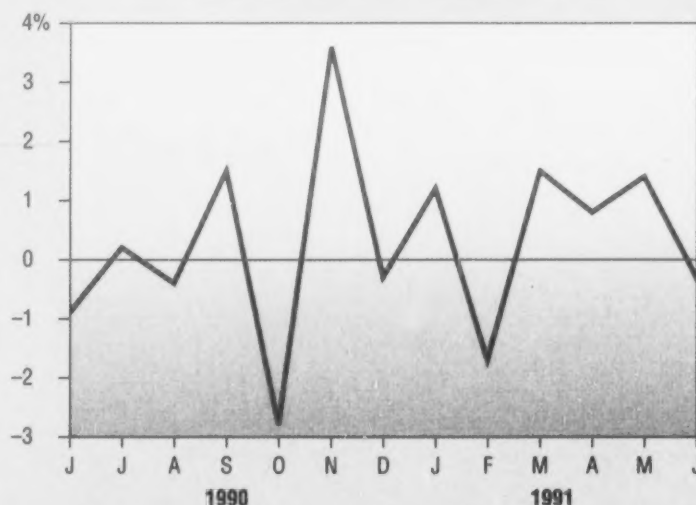
Worst growth prospects:

Government and military	8.8	8.8	11.1
Industrial electronics	10.6	7.0	12.4

**GDP adjusted for inflation; all data assumes constant exchange rates

Pacific Rim's economic leading indicator

(monthly % change, Taiwan and S. Korea only)



Source: Cahners Economics, Columbia University's Center for International Business Cycle Research, Elsevier Advanced Technology, The World Bank, Organization for Economic Cooperation and Development, International Monetary Fund, Electronic Outlook Corp.



The Electronic Business International 100

To no one's surprise, Japan takes 6 of the top 10 spots in this year's ranking of the world's largest electronics companies

By Linda Stallmann

The world's top 100 electronics companies generated \$715 billion in electronics sales in 1990, up 11% from 1989. Not surprisingly, the biggest gains came in Japan, where electronics sales jumped almost 21% to \$272 billion.

North American companies still dominate the list with 43 entries (42 U.S. and 1 Canadian), down from 47 last year. Asian companies took up the slack, bringing their number to 34. European entries remains at 23.

The five top companies profiled below accounted for \$179 billion worth of electronics goods and services—a whopping 25% of the total. Of the five, three are based in Japan, one in the U.S., and one in Germany.

in 1989, however, had been hit by a \$2.4 billion pre-tax restructuring charge. Non-U.S. operations came in at \$41.9 billion (up 13.3%), due mostly to a 17.5% increase in European revenue. Domestic operations rose 5.4% to \$27.1 billion last year and posted the best annual growth rate since 1984.

1. IBM
FINANCIAL RESULTS for the world's largest electronics company improved substantially over 1989. IBM's worldwide sales rose 10%, to \$69 billion in 1990, and net earnings climbed from \$3.8 billion to \$6 billion. Earnings

in 1989, however, had been hit by a \$2.4 billion pre-tax restructuring charge.

Non-U.S. operations came in at \$41.9 billion (up 13.3%), due mostly to a 17.5% increase in European revenue. Domestic operations rose 5.4% to \$27.1 billion last year and posted the best annual growth rate since 1984.

IBM's revenue from hardware sales was \$44 billion, an increase of 5.7%. While hardware

Vital signs: How the U.S., Europe, and Japan compare

	Electronics sales (\$ billions)	% change from prior year	Total sales (\$ billions)	% change from prior year	5-year sales growth (CAAGR)*	Net income (\$ billions)
Asia	\$271.5	20.7%	\$498.5	11.2%	10.2%	\$15.8
Europe	156.4	5.5	400.7	5.9	8.3	8.1
North America	287.5	7.7	639.4	11.9	8.6	31.7
International 100	715.4	11.4	1,538.6	9.0	9.0	55.6

All data is weighted averages except for net income, electronics, and total sales

* compounded average annual growth rate (% per year)

remained the largest single revenue generator at 63.7% of total sales, the growth rate in software and services continued to outpace it. Revenue from support services increased 15%, to \$11.3 billion; software rose 18.1%, to \$10 billion; and rentals and financing grew 30%.

During the first half of 1991, IBM has been affected by "continued weakness in global economies, competitive pressures, and product line transitions," says chairman John F. Akers. Worldwide sales during the period fell 7.8% to \$28.3 billion. Profits tumbled 74% to just \$646 million. Hardware sales dropped 19.7% while all other areas increased—support services by 17.1%, software by 6.6%, and rentals and financing by 14.4%. □

Matsushita Electric

2. THE SECOND-LARGEST electronics company weighed in at \$33.3 billion in electronics sales last year. For Matsushita—which markets under the brand names of Panasonic, National, Technics, and Quasar—fiscal 1991 was a year of solid growth. Total sales increased 10% to \$46.7 billion. Net income grew 10% to \$1.8 billion. Consolidated overseas sales (mostly in Asia and Europe) advanced 13% to \$21 billion. Domestic sales rose just 7% to \$25.8 billion. In December 1990, Matsushita acquired MCA Inc., the U.S. entertainment company, for approximately \$6.1 billion. (MCA's financial results are not included in Matsushita's consolidated fiscal year results.)

Sales growth was posted in all major product groups. Revenue from video equipment—Matsushita's largest segment, with 26% of to-

tal sales—grew 7% to \$12 billion. Communications and industrial equipment, with 24% of sales, rose 13% to \$11 billion. Home appliances, batteries, and kitchen-related products all grew 12%, while electronic components sales rose 8% and audio equipment sales, 7%.

In the first fiscal quarter of 1991, ended in June, Matsushita's profits dropped 34% to \$271 million. Sales climbed 12% to \$12.6 billion. The earnings decline was due largely to the costs associated with the MCA purchase, to a slowdown in Japan's economic growth, and to a downturn in the U.S. economy. □

3. NEC

NEC'S \$26 BILLION in sales came primarily from communications systems and equipment, computers and industrial electronics systems, and electronic devices. In fiscal 1991, ended Mar. 31, the company faced continued, but slowing, growth in demand. In this environment, sales were up 7% from the previous year to \$26 billion. Net income, however, fell 36% to \$385 million.

Classified by products, sales of communications systems and equipment came in at \$7.4 billion, a rise of 12% over the previous year, reflecting robust sales of cellular mobile communications equipment. Sales of computers and industrial electronics systems, boosted by domestic demand for PCs, reached \$12.5 billion, a 10% increase. Sales of electronic devices, which were adversely affected by the decline in memory prices, fell 2% to \$4.6 billion.

NEC's domestic sales depended upon computers and communications equipment and

% change from prior year	Net income (% of sales)	Return on equity	Return on investment	Debt to capital	Sales per employee	R&D (% of sales)	Capital expenditures (% of sales)
2.8%	3.2%	10.3%	5.6%	45.4%	\$228,191	3.3%	7.4%
-40.8	2.0	7.7	4.3	44.5	126,107	5.4	6.0
0.8	5.0	12.8	5.9	53.7	156,836	5.5	7.7
-6.6	3.6	11.0	5.5	49.6	163,003	4.8	7.1

Some companies do not have completed data

Source: ELECTRONIC BUSINESS

were supported by active private capital investment and strong consumer spending. Domestic sales rose 11% to \$20.1 billion. Overseas sales fell 3% to \$6.1 billion, largely because of falling memory prices and NEC's withdrawal from the audio-visual business in the U.S. □

4. TOSHIBA

WITH ELECTRONICS SALES climbing 17% to \$25 billion, Toshiba moved from the number-six spot in the 1990 ranking to this year's number-four position. Total consolidated sales (20% of which are heavy electrical apparatus sales) rose 10% to \$33 billion during the year ended Mar. 31 1991. Competition in the key electronics markets hurt Toshiba's margins, however, leading to an 8% decrease in profits, to \$855 million. Overseas sales rose 8%, to \$10 billion and accounted for 31% of total revenue. An active investment and acquisition program is expected to raise overseas sales to 39% of total sales by 1993.

By segment, information and communications systems sales rose 9%, to \$18 billion. Sales of notebook and laptop computers jumped 40%, to \$1.4 billion. Memory sales were flat, but sales of application-specific ICs powered total semiconductor growth to 6%. Consumer products rose 9% to \$10.7 billion. □

5. SIEMENS

SIEMENS RACKED up \$25 billion in electronics sales last year as well, \$4 million short of fourth-ranked Toshiba. In its fiscal year ended Sept. 1990, the diversified German company's total sales rose 3% to top \$37 billion; profits climbed 6% to nearly \$985 million. The 1990 acquisition of Nixdorf Computer, the integration of the Data and Information Systems Group, and the consolidation of the two units into Siemens-Nixdorf Informationssysteme was completed by year-end.

Sales increases came in all the electronics groups except for semiconductors, where revenue fell 12.2% to \$1.2 billion, and audio and video systems sales, which slid 14.7% to \$72 million. Data and information systems sales jumped nearly 30% to \$4.5 billion. Double-digit growth also was reported by defense electronics, automation, public communication networks, and industrial and building systems.

In the nine months ended June 30, 1991, total sales rose 12% over the year-ago period to reach \$30 billion. Profits rose 7% to \$710 million. Growth wasn't entirely due to extraordinary factors; Siemens cites orders up 20%. □

Editorial assistant Quang Bao contributed to this report

Notes to the ELECTRONIC BUSINESS International 100

Electronics sales: Either a published figure or an ELECTRONIC BUSINESS estimate of revenue earned by each company from sales of electronics products and services

Net income: Income from continuing operations after taxes and before extraordinary items or charges. Includes minority interest

Return on equity: Net income after taxes as a percentage of shareholder's equity (preferred stock, capital stock, surpluses, and retained earnings at the company's year end)

Return on investment: Net income as a percentage of shareholder's equity, short-term and long-term debt. Short-term debt includes the current portion of long-term debt, notes payable, and other borrowings

Debt to capital: Includes long-term and short-term debt as a percentage of shareholders' equity plus debt

Employees: In most cases, the average for the year

R&D: Company-sponsored research and development expenses as a percentage of total sales

Capital expenditures: Investment in property, plant, and equipment as a percentage of total sales

Foreign sales: Includes the country of origin's sales to other regions as a percentage of total sales

All figures shown are based on the latest available completed fiscal year, so various accounting periods are represented. Similarly, electronics sales and other financial information have been converted to dollars using an exchange rate for the average rate during each company's fiscal year. □

Top 100 International electronics companies

Company	Location	Electronics sales (\$ millions)	% change from prior year	Total sales (\$ millions)	% change from prior year	5-year sales growth (CAAGR)*	Net income (\$ millions)
1	IBM United States	\$69,018	10.1%	\$69,018	10.1%	6.4%	\$6,020
2	Matsushita Japan	33,320	9.1	46,708	9.9	6.5	1,833
3	NEC Japan	26,179	7.4	26,179	7.4	9.6	385
4	Toshiba Japan	25,048	17.2	33,232	10.4	6.8	855
5	Siemens Germany	25,044	11.6	37,321	3.4	3.0	985
6	Philips Netherlands	23,846	-2.9	30,640	-2.6	-1.5	-2,487
7	Hitachi Japan	22,853	14.2	54,759	9.3	9.1	1,629
8	Fujitsu Japan	21,031	16.5	21,031	16.5	11.9	585
9	Sony Japan	20,419	23.7	25,596	25.6	20.0	828
10	AT&T United States	16,832	1.5	37,285	3.2	1.6	2,735
11	NTT Japan	14,969	NA	44,246	3.8	NA	1,848
12	Alcatel Alsthom France	14,233	-8.2	26,456	0.1	13.0	943
13	Xerox ¹ United States	13,583	9.3	13,583	9.3	8.4	599
14	Thomson France	13,482	3.0	13,816	-1.9	4.7	-454
15	Hewlett-Packard United States	13,233	11.2	13,233	11.2	15.3	739
16	Digital Equipment United States	12,943	1.6	12,943	1.6	14.1	74
17	Mitsubishi Japan	11,776	12.0	23,471	11.4	-28.0	565
18	GM Hughes Electronics United States	11,723	3.2	11,723	3.2	4.3	577
19	Canon Japan	11,683	27.5	11,932	27.9	12.6	424
20	Motorola United States	10,885	13.1	10,885	13.1	14.8	499
21	GEC Britain	10,406	23.7	17,430	7.9	11.3	923
22	Unisys United States	10,111	0.1	10,111	0.1	15.0	-437
23	General Electric United States	9,430	5.7	58,414	7.0	12.4	4,303
24	Sharp Japan	9,000	13.4	10,847	12.0	4.7	332
25	Robert Bosch Germany	7,983	3.8	19,693	4.0	8.4	346
26	Olivetti Italy	7,392	-1.9	7,543	0.1	8.0	50
27	Ericsson Sweden	7,118	18.0	7,720	15.6	7.1	583
28	Northern Telecom Canada	6,769	10.9	6,769	10.9	9.5	460
29	Texas Instruments United States	6,567	0.7	6,567	0.7	5.9	-39
30	Samsung South Korea	6,371	12.6	6,371	12.6	21.6	103
31	Groupe Bull France	6,351	5.7	6,351	5.7	16.5	-1,247
32	Honeywell United States	6,309	4.1	6,309	4.1	8.4	372
33	NCR United States	6,285	5.5	6,285	5.5	7.8	369
34	Ricoh Japan	6,187	25.7	7,101	20.1	11.1	96
35	Apple Computer United States	5,558	5.2	5,558	5.2	23.7	475
36	Raytheon United States	5,517	3.4	9,268	5.4	7.7	557
37	Sanyo Japan	5,161	7.4	10,106	7.8	-0.4	120
38	Rockwell International United States	5,001	-0.6	12,379	-3.3	1.8	624
39	Okai Japan	4,678	4.9	4,678	4.9	11.0	70
40	Tandy United States	4,500	7.6	4,500	7.6	11.6	290
41	Nokia Finland	4,396	15.8	3,780	-2.9	15.0	90
42	Pioneer Japan	4,244	17.2	4,244	17.2	11.6	243
43	Eastman Kodak United States	4,140	-1.4	18,908	2.8	12.2	703
44	STC Britain	4,078	-11.9	4,078	-11.9	2.8	96
45	Intel United States	3,921	25.4	3,921	25.4	23.5	650
46	Lockheed United States	3,880	1.3	9,958	0.7	1.5	335
47	IRI Italy	3,834	10.2	61,391	10.2	7.8	925
48	TDK Japan	3,822	13.0	3,822	13.0	7.0	201
49	British Telecom Britain	3,618	14.2	24,180	6.8	9.6	3,824
50	Compaq Computer United States	3,599	25.1	3,599	25.1	48.2	455

NA = not available
NM = not meaningful

¹Data for Xerox's document-processing business only (omits insurance and financial services business)

*compounded average annual growth rate (percent per year)

% change from prior year	Net income (% of sales)	Return on equity	Return on investment	Debt to capital	Sales per employee	R&D (% of sales)	Capital expenditures (% of sales)	Foreign sales** (% of sales)	Rank
60.2%	8.7%	14.1%	9.7%	31.3%	\$184,631	9.5%	9.4%	60.7%	12/90
9.9	3.9	7.5	4.2	44.0	221,522	5.8	7.2	45.0	3/91
-36.2	1.5	6.2	2.4	61.6	221,865	7.6	9.9	23.4	3/91
-8.3	2.6	10.3	4.1	60.4	205,138	6.4	9.7	31.0	3/91
5.8	2.6	9.5	7.7	18.8	100,057	11.0	6.9	55.0	9/90
-671.5	-8.1	-34.2	-14.5	57.7	112,315	7.9	5.1	93.5	12/90
9.1	3.0	8.2	5.0	39.1	176,782	6.3	9.6	24.0	3/91
-4.7	2.8	7.1	3.4	52.6	144,203	11.1	10.6	24.8	3/91
13.7	3.2	7.9	3.9	50.2	226,718	5.7	11.4	73.7	3/91
1.4	7.3	19.4	13.4	30.9	136,226	6.5	9.7	NA	12/90
-14.0	4.2	6.1	3.0	49.9	167,025	4.4	25.9	NA	3/91
4.0	3.6	10.8	6.0	44.3	128,740	8.4	4.9	62.6	12/90
22.7	4.4	9.8	3.6	63.0	137,202	6.2	3.3	50.7	12/90
-597.8	-3.3	-12.2	-5.6	54.4	131,007	6.0	5.6	70.3	12/90
-10.9	5.6	11.6	8.8	24.2	143,837	10.3	7.2	54.4	10/90
-93.1	0.6	0.9	0.9	1.9	104,375	12.5	7.9	56.3	6/90
3.9	2.4	NA	NA	NA	242,002	NA	NA	19.0	3/91
-8.7	4.9	7.1	6.4	10.8	122,116	4.8	7.5	16.2	12/90
60.4	3.6	9.9	4.9	50.5	219,409	5.0	7.9	70.6	12/90
0.2	4.6	11.7	8.3	29.6	103,667	9.3	11.5	54.2	12/90
-7.6	5.3	18.4	15.6	15.3	147,054	4.6	2.7	58.7	3/91
NM	-4.3	-12.5	-6.1	51.7	134,280	7.4	4.6	51.8	12/90
9.2	7.4	19.8	5.0	74.7	196,020	2.5	7.7	25.9	12/90
12.6	3.1	NA	NA	NA	301,280	NA	NA	46.0	3/91
-10.6	1.8	8.5	6.7	21.0	109,628	6.4	8.8	51.0	12/90
-70.2	0.7	1.7	0.7	62.1	140,515	5.2	4.6	63.4	12/90
87.2	7.5	20.6	15.7	24.0	109,911	10.7	7.5	82.0	12/90
22.2	6.8	14.0	10.0	28.3	138,027	11.4	6.5	64.2	12/90
-113.4	-0.6	-1.7	-1.3	24.1	93,390	8.2	13.8	33.2	12/90
-54.0	1.6	NA	NA	NA	154,688	NA	NA	59.0	12/90
NM	-19.6	NM	NM	109.3	142,790	8.6	6.5	NA	12/90
-32.4	5.9	21.9	15.3	29.9	104,573	4.4	4.0	31.8	12/90
-10.4	5.9	20.6	16.0	22.6	114,273	8.0	6.4	61.9	12/90
-14.6	1.4	3.7	1.6	58.1	191,914	5.5	7.1	31.6	3/91
4.6	8.5	32.8	30.3	7.8	382,602	8.6	4.0	41.7	9/90
5.4	6.0	19.6	12.9	34.1	120,830	2.9	4.2	17.4	12/90
3.9	1.2	2.4	1.2	48.4	183,340	5.1	7.4	44.2	11/90
-15.0	5.0	14.9	11.3	24.5	121,451	13.7	4.3	26.2	9/90
-39.7	1.5	5.1	1.8	65.3	230,682	6.2	11.4	28.9	3/91
-10.2	6.5	16.8	10.9	35.5	115,374	0.0	2.5	6.7	6/90
25.5	1.6	4.3	2.1	51.5	154,799	5.3	4.8	55.3	12/90
16.5	5.7	11.1	9.2	16.5	277,286	3.8	6.1	58.5	3/91
32.9	3.7	10.4	5.0	52.5	140,632	7.0	1.1	46.5	12/90
-69.3	2.4	5.5	5.4	1.8	121,438	11.3	4.2	31.4	12/90
66.3	16.6	18.1	15.4	14.8	164,070	13.2	17.3	46.0	12/90
5483.3%	3.4%	14.5%	7.8%	46.3%	\$136,411	4.5%	3.4%	7.1%	12/90
26.5	1.5	NA	NA	NA	146,170	NA	NA	NA	12/90
22.8	5.3	7.8	5.6	28.5	151,672	4.8	13.5	51.3	3/91
37.8	15.8	19.5	13.2	32.3	90,427	1.8	21.0	NA	3/91
36.5	12.6	24.5	23.5	3.8	315,681	5.2	9.0	53.9	12/90

** foreign sales are those outside country of origin

Top 100 International electronics companies

Company	Location	Electronics sales (\$ millions)	% change from prior year	Total sales (\$ millions)	% change from prior year	5-year sales growth (CAAGR)*	Net income (\$ millions)
51	3M United States	\$3,530	7.1%	\$13,021	8.6%	9.9%	\$1,308
52	Asea Brown Boveri Switzerland	3,500	30.6	26,688	29.8	NA	590
53	Nintendo Japan	3,337	14.4	3,337	14.4	30.8	488
54	Alps Japan	3,271	14.8	3,271	14.8	5.1	59
55	AEG Germany	3,257	1.2	8,137	7.4	3.9	-127
56	Nippondenso Japan	3,254	31.6	10,438	16.0	NA	435
57	Omron Japan	3,250	11.9	3,287	11.6	10.9	150
58	Ford Motor United States	3,250	7.7	97,650	17.8	13.1	860
59	Westinghouse Electric United States	3,196	14.8	12,915	0.6	2.8	268
60	Litton Industries United States	3,166	-3.0	5,156	2.7	2.4	179
61	Goldstar South Korea	3,110	14.7	4,200	14.6	NA	47
62	Harris United States	3,053	37.9	3,053	37.9	9.2	131
63	Martin Marietta United States	2,983	-6.4	6,126	5.7	6.7	328
64	TRW United States	2,980	3.8	8,169	11.3	6.7	208
65	ITT United States	2,925	1.3	20,604	2.7	0.6	1,056
66	Toyota Japan	2,900	5.2	62,443	14.6	NA	2,998
67	Grundig Germany	2,887	20.0	2,887	20.0	9.3	121
68	Allied-Signal United States	2,840	-2.0	12,343	3.4	8.6	462
69	Kyocera Japan	2,754	6.1	3,264	9.5	7.7	228
70	Bayer Germany	2,647	19.0	25,769	-3.8	-1.9	1,178
71	Boeing United States	2,600	7.4	27,595	36.1	15.0	1,385
72	Citizen Japan	2,600	26.4	2,896	22.3	NA	121
73	AMP United States	2,587	8.8	3,044	8.8	13.2	287
74	Fiat Italy	2,504	30.5	47,752	10.0	15.7	1,346
75	GTE United States	2,500	16.8	18,374	5.5	5.0	1,541
76	Wang Laboratories United States	2,497	-13.0	2,497	-13.0	1.4	-629
77	DuPont United States	2,480	7.8	40,047	12.7	6.3	2,310
78	Sun Microsystems United States	2,466	39.7	2,466	39.7	84.5	111
79	Seagate Technology United States	2,413	75.9	2,413	75.9	62.2	117
80	Fuji Electric Japan	2,400	12.3	5,933	8.9	NA	157
81	Casio Japan	2,378	10.2	2,373	10.0	5.2	65
82	Emerson Electric United States	2,348	6.1	7,573	7.1	9.0	613
83	Seiko ² Japan	2,300	1.2	3,029	1.4	NA	5
84	Minolta Japan	2,300	20.4	2,622	6.6	3.7	-15
85	Pitney Bowes United States	2,283	7.7	3,196	11.1	12.3	207
86	Amdahl United States	2,159	2.7	2,159	2.7	20.2	184
87	Ascom Switzerland	2,128	11.6	2,128	11.6	NA	37
88	Racal Electronics Britain	2,022	-4.8	3,831	5.6	10.5	200
89	Matsushita Electric Works Japan	2,000	22.9	7,084	15.7	NA	228
90	Matra France	2,000	7.9	4,471	10.2	10.4	111
91	Murata Japan	1,967	12.2	1,963	11.9	6.2	178
92	McDonnell Douglas United States	1,915	16.0	16,255	11.4	7.4	275
93	Memorex Telex Netherlands	1,870	-5.7	1,870	-5.7	19.2	-274
94	Tandem Computers United States	1,866	14.3	1,866	14.3	24.0	122
95	Daewoo South Korea	1,852	9.2	1,852	9.2	NA	18
96	Mannesmann Germany	1,772	14.2	14,816	7.2	5.2	294
97	Nissan Japan	1,700	2.2	42,217	5.6	NA	345
98	Nikon Japan	1,700	6.0	2,161	7.3	NA	123
99	Yokogawa Japan	1,700	5.3	1,796	5.4	NA	70
100	Control Data United States	1,691	-42.4	1,691	-42.4	-14.4	3

²Sales of Seiko Corp. (formerly Hattori Seiko) only. Does not include sales of Seiko Epson and Seiko Instruments

% change from prior year	Net income (% of sales)	Return on equity	Return on investment	Debt to capital	Sales per employee	R&D (% of sales)	Capital expenditures (% of sales)	Foreign sales** (% of sales)	Rank
5.1	10.0	21.4	17.2	19.7	145,322	6.6	10.3	47.8	12/90
0.2	2.2	13.9	5.2	62.5	124,041	7.2	3.6	96.0	12/90
21.9	14.6	27.5	27.5	0.0	1,111,841	NA	NA	71.0	3/91
953.0	1.8	NA	NA	NA	136,320	NA	NA	31.0	3/91
-174.5	-1.6	-10.0	-2.2	77.7	105,742	5.9	5.3	44.0	12/90
-34.6	4.2	NA	NA	NA	194,822	NA	NA	23.0	12/90
9.1	4.6	9.0	5.0	44.0	195,225	6.4	11.6	18.2	3/91
-77.6	0.9	3.7	0.7	80.4	263,646	3.6	7.3	36.7	12/90
-70.9	2.1	6.9	1.7	75.8	111,336	1.5	3.1	21.3	12/90
0.3	3.5	13.8	11.3	18.0	101,905	3.2	3.7	26.5	7/90
86.6	1.1	5.7	1.7	70.3	131,246	5.5	6.2	49.6	12/90
12.5	4.3	12.1	7.1	41.0	91,398	4.8	6.3	27.8	6/90
6.7	5.3	21.3	16.1	24.3	98,805	3.5	4.4	NA	12/90
-20.9	2.5	10.9	5.9	45.7	108,056	3.8	7.2	31.2	12/90
14.5	5.1	12.4	5.8	52.7	180,737	2.7	3.6	31.5	12/90
27.4	4.8	10.4	7.3	30.4	644,745	NA	5.7	41.3	6/90
29.1	4.2	19.5	19.1	2.1	132,754	3.4	5.7	47.9	3/91
-12.5	3.7	13.7	7.5	44.8	116,664	5.8	5.5	38.8	12/90
-4.7	7.0	6.5	5.9	10.3	112,574	4.9	7.7	52.7	3/91
-10.1	4.6	11.9	9.1	24.1	150,697	6.6	8.9	79.5	12/90
105.2	5.0	19.9	19.0	4.3	170,656	3.0	5.7	58.3	12/90
77.0	4.2	NA	NA	NA	144,802	NA	NA	65.0	3/91
2.2	9.4	16.0	12.9	19.7	123,222	8.6	11.1	59.3	12/90
-51.0	2.8	9.7	4.0	58.7	157,473	3.9	7.4	43.6	12/90
8.7	8.4	16.9	6.9	59.2	119,312	1.5	18.8	16.6	12/90
NM	-25.2	-151.5	-60.7	59.9	123,722	8.9	6.1	52.5	6/90
-6.9	5.8	14.1	8.9	36.9	278,180	3.6	13.4	54.3	12/90
82.7	4.5	12.0	8.5	29.0	214,638	12.2	8.6	57.1	6/90
33493.4	4.9	17.4	9.4	46.0	63,505	4.3	4.2	35.3	6/90
59.3	2.6	NA	NA	NA	311,659	NA	NA	NA	3/91
20.8	2.7	NA	NA	NA	317,248	NA	NA	62.0	3/91
4.3	8.1	20.5	13.9	32.1	102,760	3.1	4.1	36.1	9/90
-62.8	0.2	NA	NA	NA	189,311	NA	NA	42.0	3/91
-156.8	-0.6	-2.0	-0.7	63.2	396,835	4.7	4.9	78.7	3/91
14.7	6.5	13.0	4.5	65.1	106,725	3.4	10.1	23.4	12/90
20.3	8.5	13.4	12.6	6.2	241,202	14.4	14.1	47.9	12/90
2.6	1.8	5.0	3.0	40.3	131,840	8.3	7.5	41.9	12/90
-7.1	5.2	11.7	7.5	36.1	99,619	4.6	10.8	50.0	3/91
4.8	3.2	NA	NA	NA	403,811	NA	NA	5.0	11/90
0.2	2.5	12.0	5.2	56.6	227,972	2.1	NA	45.2	12/90
31.3	9.0	NA	NA	NA	98,198	NA	NA	28.0	3/91
NM	1.7	7.8	3.0	61.4	134,128	3.8	2.5	21.8	12/90
NM	-14.7	NM	-28.3	134.7	219,994	2.6	1.4	98.4	3/91
3.0	6.5	10.1	8.6	15.2	170,618	13.6	16.1	55.6	9/90
-7.2	1.0	NA	NA	NA	126,797	NA	NA	57.0	12/90
-5.9	2.0	7.7	7.0	9.5	118,132	2.9	5.4	59.8	12/90
-57.8	0.8	NA	NA	NA	519,531	NA	NA	NA	3/91
-7.8	5.7	NA	NA	NA	251,782	NA	NA	47.0	3/91
-6.8	3.9	NA	NA	NA	201,386	NA	NA	17.0	3/91
NM	0.2	0.6	0.3	44.0	116,621	7.5	2.3	32.4	12/90

The ELECTRONIC BUSINESS International 100 is an exclusive report by ELECTRONIC BUSINESS magazine on the 100 largest publicly held international computer and electronics manufacturers. The listing was derived by analyzing company financial statements, 10-K and 20-K reports, and annual reports, as well as through interviews and estimates by the editors

The hot WAN manager market attracts a crowd

More than 100 vendors of wide-area network management products vie for a share of an embryonic market that could surpass \$2 billion by 1995

By Dwight B. Davis

Not many vendors have the luxury of tens of thousands of users begging for a broad new category of products. Among the few so privileged are suppliers of management systems for computer networks. As the number, size, and importance of computer networks grows, the demand for tools to monitor and control the communications complexes has reached a frenetic pitch.

Even "we can't get all the tools we need to manage the network," complains Neil Evans, general manager of MIS and corporate services at Microsoft Corp. of Redmond, Wash., the software giant that sells local area network (LAN) software. It's worldwide network includes more than 50 sites linking more than 22,000 PCs. Rather than using a single integrated management system, Microsoft's computer center is forced to employ an unwieldy collection of management packages to monitor different sections and functions of the network.

Robust demand and a wide assortment of products have made network management "the most dynamic area in networking today," contends Jerry McDowell, principal networking analyst at San Jose-based Dataquest Inc. Last year, U.S. sales of network management systems totaled \$687

million, according to Dataquest but are projected to approach \$1.3 billion by 1994. Worldwide sales of network management products will hit \$2.25 billion by 1995, predicts Todd Dagres, director of data communications research and consulting at the Yankee Group in Boston. Network management expenditures by MIS departments at *Fortune* 1000 companies are expected soar 28% annually, he adds.

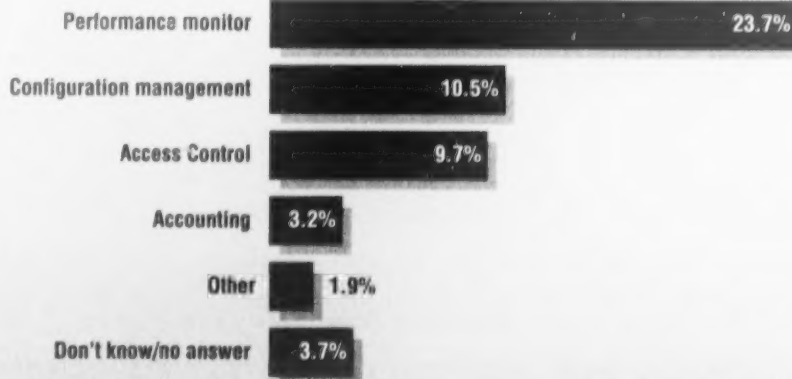
The dramatic growth forecasts are due, in part, to the relatively low market penetration of network management products. Although several analysts acknowledge a lack of penetration data, they agree that the vast majority of local area networks have only rudimentary man-

agement facilities, if any. When, and under what circumstances, a computer network needs management tools varies. The operative factor is not the number of nodes or geographic spread of a network, but the nature of the information traversing it, explains Christopher Baum, associate editor and analyst with Datapro Research Information Services in Delran, N.J. The more valuable the data, the more likely it is to find a network management system to monitor it, he notes.

"Internetworking" the numerous local area networks within large companies represents the condition most worthy of network management and the fastest-growing part of the market. Interconnected LANs

Rating the LAN environment

What are the most important issues in managing network information?
(Based on *Fortune* 1000 user survey;
percentage of respondents)



Source: Business Research Group

MARKET PERSPECTIVES

may be physically close or widely separated and may support a wide range of different devices, network operating systems, and communications protocols. Corporations with a diverse collection of networks want a single window into the entire system—an integrated network manager. Only recently have network management systems begun to address that need, and the more than 100 vendors serving the market have a long way to go to fully implement the users' goals.

Network management systems are essentially software products, although some are bundled in a workstation or personal computer. Bundled systems typically are priced from \$10,000 to \$20,000. Software-only packages exist for virtually every type of computer platform, from PCs to mainframe computers. For large, companywide management systems, the annual software licensing fee can exceed \$100,000.

Many products monitor only the physical network links and devices, detecting faults, depicting the network configuration, and informing managers, for example, of data traffic volumes and device response times. Other management functions can include everything from maintaining data security to distributing software across the network.

Most users acquire their first network management capabilities as part of a LAN operating system. Novell Inc.'s NetWare, Banyan Systems's Vines, and Microsoft's LAN Manager, for instance, perform rudimentary management tasks as part of their feature suites. Most suppliers' systems fully monitor only their own devices, although some are designed to be company-wide systems, or "managers of managers."

Only a few vendors have tackled multivendor/multiprotocol network management for an entire corporation, ultimately the most lucrative market. IBM claims to lead the companywide network management market, with about 10,000 installations of its NetView software residing on its mainframe and midrange

computers. "We have a whole family of network management products, of which NetView is just one," says Bill Warner, director of network management at the company's Networking Systems group in Research Triangle Park, N.C.,

"and we're well down the road to offering integrated network management."

Some analysts dispute IBM's claim of offering integrated network management. They say that most deployed NetView systems are used to manage only IBM networks using the company's proprietary Systems Network Architecture (SNA) protocols. In line with an industry trend to support industry-standard network management protocols, IBM is broadening NetView's repertoire, according to Warner.

Other companywide management system vendors include Digital Equipment Corp.'s DECmcc manager and AT&T's Accumaster Integrator, but the two management platforms that have garnered the broadest acceptance are Hewlett-Packard Co.'s OpenView Network Node Manager and Sun Microsystems Inc.'s SunNet Manager. A variety of network management vendors use the HP and Sun platforms as foundations for their own specialized products. In addition, Cabletron Systems, Cisco Systems, SynOptics Communications, Vitalink Communications, and other hot companies selling hubs, bridges, routers, and other gear for LANs, have network management products as well.

Both OpenView and SunNet Manager support the Simple Network Management Protocol (SNMP), the most popular standard for defining how management data is packaged and transported over a network. As



**Bill Warner, of IBM's
Networking Systems group**

of July, HP's net management systems accounted for 24% of the "generic" SNMP managers, and Sun's for 17% of the installed base, according to Mier Communications Inc., a consulting firm based in Princeton Junction, N.J.; no other SNMP manager held more than a 7% market share. Mier defines generic SNMP managers as those that can manage any network devices described in the SNMP Managing In-

formation Base II (MIB) specification, as well as any third-party MIBs written to conform to the SNMP specification. Mier forecasts that sales of generic SNMP managers will be \$89 million in 1992 and will reach 50,000 units and \$495 million in revenue by 1995.

SNMP was developed to manage TCP/IP (Transmission Control Protocol/Internet Protocol) networks. As with TCP/IP itself, SNMP is a communications protocol that evolved out of the research community that uses the federal government's Internet (formerly ARPANET) network. Competing with SNMP—albeit weakly to date—is another network management protocol called the Common Management Information Protocol (CMIP). CMIP was developed under the auspices of the International Standards Organization (ISO) and is used to manage networks that adhere to ISO's Open Systems Interconnection model.

SNMP lacks some of CMIP's features, and it isn't a recognized international standard, but networks employing ISO-standard protocols are relatively rare due to the success of TCP/IP, the "dominant" transport protocol used on LANs today, says Yankee Group analyst Dagres. In addition, he estimates, as much 30% of the internetworking traffic over wide area networks is TCP/IP based. Consequently, virtually every management system vendor already supports SNMP or is

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scrambling to do so. Most also intend to support CMIP as well, but SNMP's proliferation has slowed user demand for the international standard.

"The explosion of TCP/IP since 1988 took us by surprise, but we have acted quickly to support it and SNMP," says Tony Viola, network management marketing manager at Digital Equipment in Merrimack, N.H. DEC expects CMIP and other ISO protocols to eventually dominate the networking marketplace but, for now, SNMP vendors are serving as the "conscience of the industry," Viola says. "The SNMP community's attitude is: If you see a need today, get a product out by Friday," he explains. "That approach is keeping us vendors on our toes as to what functions are needed." Kevin O'Neil, vice president of network research and consulting at the Business Research Group in Newton, Mass., adds that CMIP and other ISO-based standards will grow in popularity but "the process now looks more like a decade-long event."

EVEN IF A CLEAR winner emerges from the SNMP/CMIP face-off, other categories of protocols must also be incorporated into net management. "To build a network management product, you need anywhere from half-a-dozen to 30 standards, of which CMIP [or SNMP] is just one," says William Gilbert, president of the Network Management Forum in Bernardsville, N.J., a consortium of industry vendors and corporate users organized to publish specifications that would allow vendors to build interoperable products.

For the near term, management system vendors will offer products that support a variety of industry-standard and proprietary protocols. "At the moment, we don't have the luxury of supporting a single network management protocol," says Bernard Harguindeguy, product line manager of network management and communications products at Novell in Sunnyvale, Calif. ☐

Time's running out for U.S. connector makers

If 1991 taught vendors anything, it's that the world market is too crowded and too unforgiving for companies that can't think big

By Barbara Jorgensen

Few connector makers will be sorry to see 1991 end—it's been the industry's worst year since 1985. Sales were sluggish throughout Europe and downright terrible in the U.K., where sales are predicted to endure a 15% year-to-year drop. Demand was also lousy in the United States, where the recession choked growth in major connector end markets such as computers and autos. Overall, North American connector sales contracted 3%.

Stir in declining profits margins—U.S. manufacturers tried to raise prices just 2% to 3% but were largely unsuccessful—and you see just how bad 1991 was for connector manufacturers. Gross margins for major U.S. connector makers averaged 34% or

the lowest since 1985 when it was 32%, according to market analyst Jerry Labowitz, first vice president at Merrill Lynch.

Market overcrowding was yet another factor. Worldwide, there are more than 1,200 suppliers fighting for a piece of the roughly \$18 billion merchant connector market. They can't all survive in the current market conditions, and they won't. Here's the current supplier headcount by region: North America, 912; Europe, 445; Japan, 215; and the Pacific Rim, 370.

"Take it from our customers' point of view," says Norris Tolson, VP for Du Pont's connector division. "They hear company A is closing, company B is closing some of its operations, and company C is restructuring.

They'll conclude that the connector industry is oversupplied and cut-throat, and that our price list is good only for drawing pictures on."

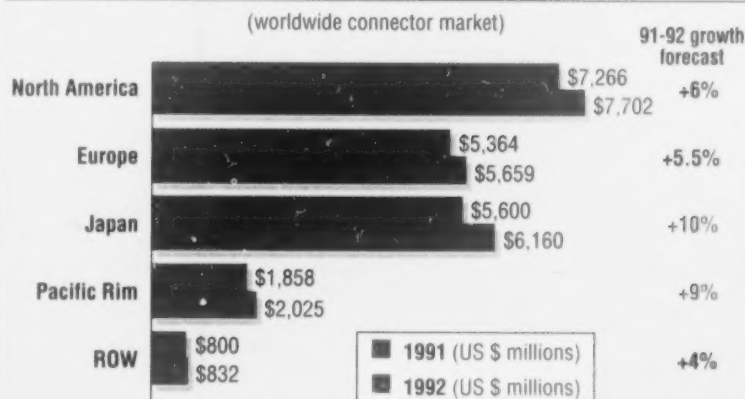
This year's only bright spots were pockets of strong growth—in Japan and the Pacific Rim, where sales are expected to finish the year up 22% and 10%, respectively, according to Ken Fleck, of Fleck International in Huntington Beach, Calif.

Not surprisingly, connector makers are chasing the business as it moves east. About 41% of Japan's connector suppliers are foreign-based, says Fleck. That compares with 48% in the U.S. and 52% in Europe. Success by foreign manufacturers in Japan remains limited. Of the top 10 suppliers in Japan, only two—Amp and Molex—are not Japanese.

Next year ought to be better for connector makers. How much better isn't clear. Sales are expected to rise 6% in North America and 5% in Europe. That's good, but its not great. Conversely, Japanese sales growth will slow to a still impressive 10%, while Pacific Rim sales growth flattens at 9%. A big opportunity, say observers, is planned work on the telecommunications infrastructure throughout the Pacific Rim region—notably Malaysia, the Philippines, and Thailand.

Globally positioned companies can still prosper—if they sell into those growth pockets—advised speakers at the recent Fleck-sponsored International Connector Congress in Tarpon Springs, Fla. So can niche suppliers with expertise in a few high-end products. Hot product areas

North America still the largest market, but high growth lies east



Source: Fleck International

MARKET PERSPECTIVES

identified include fiber-optic connectors, SCSI II interfaces, Z-packs, .050-inch and .025-inch pitch devices, and Futurebus+ connectors, according to conference speakers.

The niche formula, says Fleck, has become increasingly successful. During the past five years, he notes, industry giants such as Amp, Molex, and 3M had an average cumulative sales growth of 19.7%. Compare that with 66.3% growth in the U.S. and 195.4% in offshore sales by niche players such as Omni Spectra and Samtech. During the same period, midsize U.S. companies with many product lines but little capital grew by only 1.7%. Clearly, the midsize players are being squeezed out.

Japan, despite its slowed growth, will remain the most robust market for connectors in 1992. Much of the demand will stem from cost-sensitive consumer applications such as

camcorders and VCRs. Japan is also a big producer of fax machines and notebook computers, two markets that are expected to boom.

Selling into Japan, though, isn't easy. Obtaining preferred-supplier status can be a prerequisite for doing business with large Japanese companies. To do that, says Ivor Redmonde, director of strategic research for Molex Inc. in Lisle, Ill., connector manufacturers must be able to do the following:

- Supply product to the customer's assembly line within one hour of the specified delivery time;
- Supply reel-mounted product such as capacitors that can be surface-mounted and placed onto boards at the same speeds;
- Provide connectors with 0.020-inch centerline spacing;
- Completely change connector designs to meet new-cycle

requirements within 12 to 16 weeks.

Competing with foreign connector suppliers already entrenched in Japan is also difficult. Fleck characterizes the market as closed. That said, opportunities still exist for technologically innovative and cost-competitive U.S. vendors. "You are going to have to bring to the party a technological breakthrough, not a 'me-too' product," advises William Hudson, executive vice president, international, of Amp.

THERE SEEMS TO BE general agreement that Pacific Rim nations comprise an easier-to-penetrate market for foreign connector makers. Not only is the entire region growing rapidly, both as a market

European growth won't surge until 1993

NEITHER European connector manufacturers such as Germany-based Hartig Elektronik nor U.S.-based giant Amp foresee sweeping changes when the calendar flips to 1992. Both say demand will be flat, although industry analyst Ken Fleck forecasts 5% growth in 1992 and 7% in 1993. That's much better than 1991's anemic 2.6% gain.

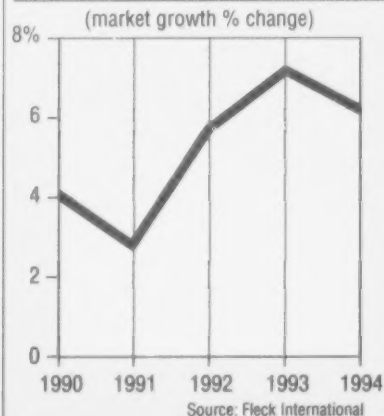
Whether lifting the barriers between European countries during 1992 will have a dramatic impact on the connector business is still being debated. "There will be some opening up of new markets but no overall greater growth," says Amp chairman William Hudson.

To a considerable extent, access to the European market hasn't been a problem. "I don't see the industry being adversely affected by 1992," says Fleck. "Many U.S. connector manufacturers have facilities in Europe. They are already part of the landscape; but for those with no presence, 1992 may make it more difficult."

Germany and Italy are the only countries that had growth in 1991, based largely on demand from automotive, telecommunications, and consumer electronics. Those pockets of strength are expected to continue. Predicted connector demand in the United Kingdom remains slight.

One nagging question for U.S. manufacturers selling into Europe is how the currency fluctuations will affect business. Though still comparatively low, the U.S. dollar has edged up against most European currencies, making U.S. products more expensive. The exception, of course, has been the United Kingdom, where the dollar remains low. Most forecasts call for continued strengthening of the greenback, which could shift demand away from U.S. connector manufacturers. That is something most Europeans hope happens since Europe still has a con-

Connector growth in Europe peaks in '93



siderable trade deficit.

As elsewhere, European buyers are pressing connector makers for low pricing and extended services. Jean-Lucien Lamy, president of Labinal's worldwide connector operation, says customers want suppliers who can design parts to cost, provide worldwide service, JIT, and buffer stocks. Many connector makers, he says, are trying to contain their costs by setting up manufacturing in low-cost labor areas, such as Portugal. □

MARKET PERSPECTIVES

and manufacturing base, but it's also trying to increase the sophistication of the products manufactured there. That shift from low-tech to high-tech manufacturing may create increased demand for high-end connectors made by foreign companies. The rationale is simple. Higher performance computer-based systems will require higher-performance connectors, which are not widely manufactured by PacRim connector makers.

Even here, U.S. vendors run against Japanese influence. Case-in-point: When NEC and AT&T were competing for an Indonesian telecom system contract, AT&T clearly had a price and technology advantage, but NEC—and its Japanese connector makers—got the contract. The reason: Japan invests \$2.5 billion annually in Indonesia.

South Korea is another emerging opportunity. On a recent trip there, Molex's Redmonde noted increased activity in the mainframe and telecommunications production, with emphasis on meeting Europe's 1992 "hard" metric requirements. That represents an opportunity to sell 2.0- and 2.5-millimeter connector systems required for those projects, he says, adding the same connectors are likely to be used in the digitizing the Korean communication system.

Taiwan remains a major force in low-end, low-price connectors and has more than 300 connector manufacturers. While these companies will continue to pump out connectors for cost-sensitive applications, there is a growing belief that demand for higher-performance connectors will grow. That's

because Taiwan, like Singapore, is making a deliberate effort to climb the technology manufacturing ladder. Government efforts to attract IC fabrication facilities are the most obvious sign of that trend.

Redmonde notes Taiwan is poised to mass-produce 4 Mbit DRAMs and plans to have 0.7-micron CMOS capability by mid-1992. Taiwan also has aggressively pursued the establishment of multi-unit consortia to develop consumer-information equipment for export. As the locally produced ICs are incorporated into locally manufactured systems, demand for high-end connectors will also grow. At least that's the theory. □

North America: Still the biggest market

DESPITE A SHIFT in demand toward the Far East and the ongoing recession, the North American market still accounts for 34.8% of the worldwide connector market. Nearly half of those sales now go to foreign suppliers. Market analyst Ken Fleck projects 6% growth for North American connector sales in 1992, but only a compounded annual growth rate of 4.3% through 1995.

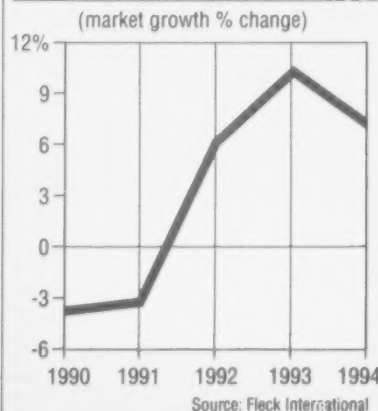
A big question mark is the U.S. recession. When will it end, and how vigorous will the recovery be? No one knows for sure, but one connector industry economist who foresees a brighter 1992 is 3M's John McDevitt. He contends the effects of the North American Free Trade Pact will kick in sooner than many expect and the connector industry will benefit. "It's a market of 361 million people," says McDevitt, "with a GNP a quarter larger than the European Community's. The market for connector manufacturers will be telecommunications, particularly in Mexico."

That market is attracting more worldwide attention. As with

Japan, the Four Tigers of the Orient—Singapore, Taiwan, South Korea, and Hong Kong—are beginning to compete with connector makers in North America. One weapon is price. Amp chairman William Hudson claims to see more small companies from Hong Kong, Taiwan, and China selling through agents and competing on price. "Price erosion is a fact," he says, "and, except for sophisticated accounts, many customers will continue to buy on price."

Whether that's sour grapes or a legitimate gripe depends on which end of the food chain you talk to. Connector users aren't complaining. Some foreign suppliers are also winning on service, they say. Once hampered by distance from the customer, foreign manufacturers can now communicate engineering specs and get replies and changes within minutes. "We've underestimated the impact of the fax machine," Fleck remarks. "What's worked for U.S. manufacturers

North American connector market can only get better



has also worked for the Taiwanese."

On the bright side, North American companies are better equipped than ever before to meet competition. The recession has been a painful tool that has forced needed change. Says Fleck, "U.S. companies are healthier, their costs are under control, there's less overhead and waste, and there's higher productivity, which will help spark even a modest rebound and allow revenue to fall to the bottom line." That, of course, is what they hope. □